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PATTERNS OF PERCEPTUAL-MOTOR AND INTELLIGENCE SCORES FOR LEARNING DISABLED ELEMENTARY STUDENTS

A. Winston Rutledge

A dissertation presented to the
Graduate Faculty of Middle Tennessee State University
in partial fulfillment of the requirements
for the degree Doctor of Arts

December, 1977

PATTERNS OF PERCEPTUAL-MOTOR AND

INTELLIGENCE SCORES FOR LEARNING

DISABLED ELEMENTARY STUDENTS

APPROVED:

Graduate Committee:

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ABSTRACT

PATTERNS OF PERCEPTUAL-MOTOR AND
INTELLIGENCE SCORES FOR LEARNING
DISABLED ELEMENTARY STUDENTS

by A. Winston Rutledge

The present study was undertaken in an effort to determine the relationship of varying degrees of performance and verbal ability, as measured by WISC scores, and six measures of perceptual-motor (PM) ability. These six PM measures were previously found to be significantly related to standard achievement scores in elementary students. One hundred and five students, 8 to 14 years of age, who were primarily at the fourth-grade level were divided into four groups. Twenty-five students represented all of the high achievers (HA) of one school district at this grade level. Three other groups included learning disabled students who had been certified by a specialist according to the minimum standards and regulations of the State of Tennessee. These

groups, numbering 28, 26, and 26 respectively, represented all of the relatively high performance (HP), relatively high verbal (HV), and performance equals verbal (P=V) learning disabled fourth and fifth grade students from two school districts. The HV and HP groups were equated for FSIQ (WISC), 85.7 and 84.3 respectively. The IQ of the P=V group, 98.0, was intermediate between the HP, HV, and the HA (113.9) groups. It was hypothesized that the six PM tests were positively related to the educational success of the subjects of this study. This hypothesis was accepted. It was hypothesized that within the intelligence range of the subjects of this study, a positive relationship existed between WISC FSIQ and each perceptual-motor test. This hypothesis was accepted. It was hypothesized that the HA group would outperform all other groups. Significance was reached in two to six PM tests. The HP group was hypothesized to score significantly lower on the PM tests than any other group. Significance was reached on four to six PM tests. The FSIQ range for all subjects was from 67 to 144. The pattern of PM scores indicated the scores were related to the strength of PIQ WISC irrespective of verbal score. While all group PM scores were not significant, the pattern of the results suggests consistency of the hypotheses. A hierarchy of PM ability appeared to exist from the results of this study in the order of (1) HA group, (2) HP and P-V groups, and (3) HV group.

ACKNOWLEDGEMENTS

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Chapter 1

INTRODUCTION

The learning disabilities field, as a fairly new area in education, has had its beginnings and early growth in the past few years. Estimates (as high as one in five children) suggest that these students of average intellect (or above) have perceptual, cognitive or coordinative problems of neurological origin which may interfere with optimum achievement in the regular classroom.[1] In the past such children have been labeled as dyslexic, educationally handicapped, hyperactive, minimally brain-damaged, and perceptually handicapped.[2]

The Association for Children with Learning Disabilities, formed in 1964, provided a vehicle for the acceptance of single label and the establishment of a set of criteria for purposes of identification. Disabilities related to

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[1]D. D. Hammill and N. R. Bartel, eds., Educational Perspectives in Learning Disabilities (New York: John Wiley and Sons, 1971), p. 14.

[2]Ibid., p. 1c.

visual perception, cognition, auditory and visual memory, impulsivity and sensory integration are individual and these are not completely understood at this time. No two children are thought to ever have exactly the same problem with respect to abilities and disabilities.[3]

> The many and varied problems of neurological origin which interfere with effective learning seem to defy classification. They are sometimes categorized as nonverbal (placing emphasis upon perceptual-motor deficits), social immaturity and behavioral abnormalities, and verbal (placing emphasis upon language disorders).[4]

STATEMENT OF THE PROBLEM

The relation of perceptual-motor skills with intelligence, reading and academic achievement has been the substance of a number of theories and studies in various fields. Much energy has been expended, with little avail, in many investigations that propose to increase achievement, reading ability and intellectual potential by the use of

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[3]Association for Children with Learning Disabilities, annual conference, meeting of executives of the organization and selected professionals, New York, 1967.

[4]H. F. Fait, Special Physical Education (Philadelphia: W. B. Saunders Co., 1972), p. 169.

perceptual-motor training techniques.[5] While most studies have found that perceptual-motor training techniques do, in fact, increase perceptual-motor ability, the relation is quite small with respect to an increase in the area of cognitive ability.[6] The majority of the research[7] seems to indicate that perceptual-motor ability is a prerequisite to developmental maturity and that, generally speaking, developmental maturity is related in a positive way to cognitive skill acquisition.

Skubic and Anderson[8] have investigated the relationship of perceptual-motor achievement, academic achievement and intelligence in fourth grade students of normal intelligence. They found a significant relation between scores on measured intelligence and achievement on six of eleven perceptual-motor tests. The importance here lies in the

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[5]J. D. Saphier, "The Relation of Perceptual-Motor Skills to Learning and School Success," Journal of Learning Disabilities, 6, No. 9 (1973), 583-592.

[6]Ibid.

[7]Ibid.

[8]V. Skubic and M. Anderson, "The Interrelationship of Perceptual-Motor Achievement, Academic Achievement and Intelligence of Fourth Grade Children," Journal of Learning Disabilities, 3, No. 8 (1970), 413-420.

delineation of the six perceptual-motor tests and the implications for further study.

The purpose of the present study was to investigate the above six perceptual-motor (PM) tests as they pertained to four groups of primary students, three learning disabled and one high-achieving, divided according to strength of verbal and performance ability as measured by WISC scores. Will these perceptual-motor skills, as measured by the six perceptual-motor tests, be related to varying degrees of WISC verbal and performance ability? The question of whether these perceptual-motor tests will relate to the educational success of the low and high achievers of this study is relevant. Another question concerns whether a positive relationship exists between intelligence (WISC) and each PM test. Is performance ability on the PM tests related to WISC performance and verbal results with respect to the four groups of primary students? Are the six PM tests related positively to standard achievement scores of a high performance group or a high verbal group? Thus, the reference criteria were the six PM tests and their relation to the scores of four groups of primary students on these tests.

SIGNIFICANCE OF THE STUDY

The writer divided a group of learning disabled students into categories according to discrepancies between WISC Verbal and Performance abilities in a manner similar to Rourke, Young and Flewelling.[9] The writer, a school psychologist, has found few such related studies to categorize learning disabled students in such a manner but it should be expected that future research will tend to bear more directly with the high performance and verbal ability student.

DELIMITATIONS

1. The study was limited to elementary grade level students who were primarily at the fourth grade level in two school districts of the Upper Cumberland Region of the State of Tennessee.

2. Both the Wechsler Intelligence Scale for Children and its revised form were used in this study. Each student was administered one or the other of these scales. The

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[9] B. P. Rourke, G. C. Young, and R. W. Flewelling, "The Relationships between WISC Verbal-Performance Discrepancies and Selected Verbal, Auditory-Perceptual, Visual-Perceptual, and Problem-solving Abilities in Children with Learning Disabilities," Journal of Clinical Psychology, 27, No. 4 (1971), 475-479.

Bender Visual-Motor Gestalt Test and the Myklebust Pupil Rating Scale were used in addition to the six perceptual-motor tests, as modified by Skubic and Anderson,[10] in order to gather data relevant to the outcome of this project. Other information was garnered from relevant school personnel and from the cumulative records of the students.

LIMITATIONS OF THE STUDY

Due to the geographical and socio-economic considerations of this particular area, this study may not be entirely relevant to, or necessarily representative of, other regions in the United States or elsewhere.

DEFINITION OF TERMS

EMR. Educable mentally retarded.

FSIQ. Full scale intelligence quotient.

High Performance Student (HP student). The learning disabled student. This student is certified by a specialist and assigned to a special class. His minimum PIQ of 79 is at least 12 points higher than his VIQ and he is one-half year or more deficient in reading, spelling or mathematics

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[10] Skubic and Anderson, loc cit.

achievement as measured by the Metropolitan, Stanford, or Wide Range achievement tests.

High verbal student (HV student). The learning disabled student whose minimum VIQ of 79 is at least 12 points higher than his PIQ and who is certified by a specialist and assigned to a special class. This student is one-half year, or more, deficient in reading, spelling or mathematics achievement as measured by the Metropolitan, Stanford, or Wide Range Achievement tests.

Performance equals verbal student (P=V student). The learning disabled student (certified by a specialist and assigned to a special class) whose WISC protocol finds no significant discrepancy between PIQ and VIQ.

Learning disability. Children with special learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written language. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling, or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia, and others. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance or to environmental deprivation.[11]

Low achieving student. That student achieving at least one-half grade level below grade placement or age expectancy or both, in basic academic subjects as measured by the Metropolitan, Stanford, or Wide Range achievement tests.

High achieving student. That student achieving at least one-half grade level above grade placement or age expectancy or both in basic academic subjects as measured by the Metropolitan, Stanford, or Wide Range achievement tests.

Performance intelligence quotient on the Wechsler Intelligence Scale for Children. (PIQ-WISC)

PM. Perceptual-motor.

Perceptual-motor skill. A process of attaining increased skill and ability to function involving such

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[11]National Society for Crippled Children and Adults, Inc., and the National Institute of Neurological Diseases and Blindness, of the National Institutes of Health, Minimal Brain Dysfunction in Children, NINDB Monograph 3 (Washington: Department of Health, Education and Welfare, 1966).

elements as input, organization, integration, output, response and feedback.[12]

Verbal intelligence quotient on the Wechsler Intelligence Scale for Children. VIQ-WISC.

WISC. Wechsler Intelligence Scale for Children.[13]

WISC R. Wechsler Intelligence Scale for Children Revised.[14]

WISC FSIQ. Wechsler Intelligence Scale for Children full scale intelligence quotient.

BASIC ASSUMPTIONS

1. The various instruments used in this study were considered to be capable of gathering the relevant data in a valid and reliable way.

2. The primary students involved in this study would be responsive to the instruments used in this experiment.

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[12] M. Vannier, M. Foster, and D. L. Gallahue, Teaching Physical Education in Elementary Schools, 5th ed. (Philadelphia: W. B. Saunders Co., 1973), p. 48.

[13] D. I. Wechsler, Wechsler Intelligence Scale for Children (WISC) (New York: Psychological Corporation, 1949).

[14] D. I. Wechsler, Wechsler Intelligence Scale for Children Revised (WISC R) (New York: Psychological Corporation, 1974).

3. The WISC and/or WISC R were administered according to the standardized procedures and the students were assumed to be in a similar frame of mind when evaluated by the same examiner.

4. The time of day, week, or year had no appreciable influence with respect to the various tests administered upon the results of this study.

5. Other influences, such as the examiner influence or the expectancy effect, had no appreciable effect upon the results of this study.

HYPOTHESES

For the purposes of this study, the following hypotheses were developed:

1. The six perceptual-motor tests were related to the educational success of the subjects of this study.

2. Within the intelligence range of the subjects of this study, a positive relationship existed between WISC FSIQ and each perceptual-motor test.

3. The HP, HV and P=V groups would exhibit a significantly lower performance score for the total battery of six perceptual-motor tests than the HA group.

a. The hypothesis was applied to PM test 1.
b. The hypothesis was applied to PM test 2.
c. The hypothesis was applied to PM test 3.
d. The hypothesis was applied to PM test 4.
e. The hypothesis was applied to PM test 5.
f. The hypothesis was applied to PM test 6.

4. The HV group would score significantly lower on the total battery of six perceptual-motor tests than any other group.

a. The hypothesis was applied to PM test 1.
b. The hypothesis was applied to PM test 2.
c. The hypothesis was applied to PM test 3.
d. The hypothesis was applied to PM test 4.
e. The hypothesis was applied to PM test 5.
f. The hypothesis was applied to PM test 6.

5. Differences in scores between the HP group and the PxV group would fail to reach significance for the total battery of six perceptual motor tests.

a. The hypothesis was applied to PM test 1.
b. The hypothesis was applied to PM test 2.
c. The hypothesis was applied to PM test 3.
d. The hypothesis was applied to PM test 4.
e. The hypothesis was applied to PM test 5.
f. The hypothesis was applied to PM test 6.

Supplementary correlations were calculated to determine possible interrelationships among the variables.

Chapter 2

REVIEW OF RELATED LITERATURE

Research related to perceptual-motor achievement as it pertains to the HP and HV student, as defined in this study, is sparse. The review of related literature will be divided into two sections. The first section will present those few studies directly related to the present study. The second section will concentrate on indirectly related studies in an attempt to develop background information.

DIRECTLY RELATED STUDIES

The studies directly related to this study include Rourke, Young and Flewelling,[1] Rourke and Telegdy,[2] and

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[1]B. P. Rourke, G. C. Young, and R. W. Flewelling, "The Relationships between WISC Verbal-Performance Discrepancies and Selected Verbal, Auditory-Perceptual, Visual-Perceptual, and problem-solving Abilities in Children with Learning Disabilities," Journal of Clinical Psychology, 27, No. 4 (1971), 475-479.

[2]B. P. Rourke and G. A. Telegdy, "The Lateralizing Significance of WISC Verbal-Performance Discrepancies for Older Children with Learning Disabilities," Perceptual and Motor Skills, 33, No. 3 (1971), 875-883.

Skubic and Anderson.[3] The former studies found the HP student superior to the HV student, at the 4th or 5th grade level, on measures that primarily involve visual-perceptual skills. They found the HV student to be superior to the HP student on measures of verbal abilities and auditory-perceptual skills.

Skubic and Anderson, in the latter study, found six PM measures to be significantly related to standard achievement in elementary students. They state that it is generally conceded that all unpracticed, voluntary acts involve purpose and problem-solving and, therefore, involve prior programming by the brain.[4] They tell that such programming includes organization, differentiation and integration of a number of parameters that involve perception, cognition, retention as well as data processing and feedback. It is their estimate that the successful completion of a voluntary motor act is the result of an extremely complicated process, and as the complexity of the problem increases, the degrees of freedom increase and the cortical involvement

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[3]V. Skubic and M. Anderson, "The Interrelationship of Perceptual-Motor Achievement, Academic Achievement and Intelligence of Fourth Grade Children," Journal of Learning Disabilities, 3, No. 8 (1970), 413-420.

[4]Ibid.

becomes greater. They conclude that it would appear logical that those persons who can successfully solve complex perceptual-motor problems are more likely to meet with success in solving purely conceptual problems, but not necessarily vice versa. They suggest that there is little factual evidence available to indicate the precise relationship of perceptual-motor ability to conceptual ability and to intelligence, and the results are far from conclusive. Low correlations between intelligence and various types of motor performance have been reported by Ryan,[5] Shaffer,[6] Singer,[7] and Singer and Brunk.[8] Biddulph,[9] Ismail and

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[5]E. D. Ryan, "Relative Academic Achievement and Stabilometer Performance," The Research Quarterly, 34 (1963), 184-190.

[6]G. Schaffer, "Interrelationship of Intelligent Quotient to Failure of Kraus-Weber Test," The Research Quarterly, 30 (1959), 75-86.

[7]R. Singer, "Interrelationship of Physical, Perceptual-Motor, and Academic Achievement Variables in Elementary School Children," Perceptual and Motor Skills, 27 (1968), 1323-1332.

[8]R. N. Singer and J. W. Brunk, "The Relationship of Perceptual-Motor Ability to Intellectual Ability in Elementary School Children," Perceptual and Motor Skills, 24 (1967), 967-970.

[9]L. G. Biddulph, "Athletic Achievement and the Personal and Social Adjustment of High School Boys," The Research Quarterly, 21 (1954), 1-7.

Gruber,[10] and Rarick and McGee[11] report more significant findings.

INDIRECTLY RELATED STUDIES

Studies indirectly related to the present study begin with Ismail and Gruber who found with fifth and sixth grade students coordination and balance tasks and tasks involving gravity responses were good predictors of academic achievement. Speed, power and strength items held little predictive power for estimating intellectual achievement.

Even though sufficient research is lacking, it does seem reasonable to conclude that those children in kindergarten and the early grades who possess average intelligence but whose motor responses are inadequate tend to experience difficulty in learning, formally or informally. Such children experience problems, according to Skubic and Anderson[12] in building a systematic body of information and show limitations

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[10] A. H. Ismail and J. J. Gruber, Integrated Development: Motor Aptitude and Intellectual Performance (Columbus: Charles E. Merrill Books, 1966).

[11] L. Rarick and R. McGee, "A Study of Twenty Third-Grade Children Exhibiting Extreme Levels of Achievement on Tests of Motor Efficiency," The Research Quarterly, 20 (1949), 142-152.

[12] Skubic and Anderson, loc. cit.

in learning. They state that it is not clear, at this time, whether these children overcome these difficulties or compensate for them by the time they reach the fourth grade. Nor is it clear, they state, whether the children who are high achievers in the classroom are also superior in performing perceptual-motor types of activities.

Saphier[13] tells, in part, that while theory posits a causitive connection between kinesthetic awareness and later perceptual and conceptual abilities, the research is more conservative and seeks to establish only correlation, and with inconsistent results. The research takes two tacks. The first, represented by Skubic and Anderson, attempts to correlate motor performance on kinesthetic tests with school success;[14] the second attempts to show improved academic performance as a result of kinesthetic training and this type of research is represented by Alley[15] and Ball and Owens.[16]

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[13]J. D. Saphier, "The Relation of Perceptual-Motor Skills to Learning and School Success," Journal of Learning Disabilities, 6, No. 9 (1973), 583-592.

[14]Skubic and Anderson, loc. cit.

[15]G. R. Alley, "Perceptual-Motor Performances of Mentally Retarded Children after Systematic Visual-Perceptual Training," Journal of Mental Deficiency, 33 (1968), 247-280.

[16]T. S. Ball and E. P. Owens, "Reading Disability, Perceptual Continuity, and Phi Thresholds," Perceptual and Motor Skills, 20 (1965), 335-365.

Saphier[17] finds that such motor training studies suffer from training periods of insufficient length in the case of educable mentally retarded. Some studies only prove that sensorimotor training improves sensorimotor performance while attempting to relate the training to school achievement. His view is that perceptual-motor deficits may or may not lead to learning disabilities in a given child. Distinct factors or elements in the perceptual-motor spectrum have not been identified according to Saphier[18] and diagnostic tests cannot yet validly isolate separate and irreducible factors.

Cruickshank,[19] with regard to the term "learning disabilities," suggests that irrespective of the presence or absence of diagnosed neurological dysfunction, learning disabilities are essentially and almost always the result of perceptual problems based on the neurological system. Visual-motor problems, basic to recognition of letters, numerals, writing, reading and arithmetic, are equally

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[17]Saphier, op. cit.

[18]Ibid.

[19]W. M. Cruickshank, "Some Issues Facing the Field of Learning Disability," Journal of Learning Disabilities, 5, No. 7 (1972), 380-388.

accurately described as visual-perceptual-motor problems. Auditory-motor problems, basic to attention, language production, and response to the auditory environment, are more accurately described as audio-perceptual-motor problems. Tactual-perceptual problems, related to learning through feeling and physical sensation, must be considered in understanding these children and their areas of dysfunction. Perception and perceptual dysfunction in relation to a motor response to a stimulus, perceived or misperceived, are the bases to the great majority if not all of the learning problems of these children.[20] Cruickshank tells that the term "specific learning disabilities" is more appropriate at this time. His finding is that the long-term solution to the problems of children with perceptual impairments is primarily an educational problem.

Kershner[21] has found that perceptual-motor training will be the most effective when used preventively rather than remedially and when the programs are implemented during the early years of development at the time the child is in

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[20] Ibid.

[21] J. R. Kershner, "Visual-Spatial Organization and Reading Support for a Cognitive-Developmental Interpretation," Journal of Learning Disabilities, 8, No. 1 (1975), 30-36.

Piaget's preoperational state. It is Kershner's idea, in the cognitive-developmental model, that perceptual development is a relatively primitive and early acquisition and is regulated by a developing system of conceptual spatial awareness. He tells that it may be more effective to teach nonverbal thinking strategies involving the mental representation and internal manipulation of spatial relations. In this connection, Piaget and Inhelder[22] find that distancing behaviors (in which there is a delay between stimulus and response), imitation activities, and reasoning about spatial events involving complex, visual thinking and spatial concepts may, in reverse order, solve visual-spatial problems that are currently diagnosed as perceptual handicaps.

Bannatyne[23] suggests that authors of research reviews take a slightly more tolerant attitude to those who do basic exploratory research. He finds that in the beginning stages of any science, "research" is usually a matter of searching, sorting and sifting for indication, hints and clues, slowly

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[22] J. Piaget and B. Inhelder, The Child's Conception of Space (New York: Norton, 1968).

[23] A. Bannatyne, "Research Design and Progress in Remediating Learning Disabilities," Journal of Learning Disabilities, 8, No. 6 (1975), 345-348.

developing hypotheses which have to be constantly modified, while gradually building a tentative body of knowledge from which again we venture forth into second order hypothetical deductive research. His conclusion is that we have not yet reached this latter state in learning disabilities. Solid research based facts will come in the future only if we do not prematurely throw away precious clues and tentative data.

Bannatyne[24] suggests that perhaps reading consists of as many as hundreds of variables, not necessarily interrelated, but all struggling to take up part of the variance in those correlations and tests for significant differences. He states that it would not be too difficult to list at least two hundred human factors that contribute directly to the reading process.

Belmont, Flegenheimer, and Birch[25] compared perceptual training and remedial instruction for poor beginning readers

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[24] Ibid.

[25] I. Belmont, H. Flegenheimer, and H. G. Birch, "Comparison of Perceptual Training and Remedial Instruction for Poor Beginning Readers," Journal of Learning Disabilities, 4, No. 2 (1971), 230-235.

and found that neither method was superior to the other. This study, along with others, suggests a need for additional correlation studies.

Gruber[26] suggests as guidelines for future research that a valid rationale for programming physical education activities for children with learning disabilities should be developed. It is suggested that all literature be surveyed and descriptive studies on children be conducted to identify variables that can be measured. Some perceptual-motor tests already exist. It is suggested that the information from each learning disability category be submitted to factor analysis to identify the traits that programs attempt to improve. Different factors may operate in different types of learning disability and may need to be dealt with by separate physical education programs. Gruber[27] suggests that the contribution of certain types of motor proficiency such as balance and coordination in estimating intellectual performance should be determined. Lastly, he concludes that research should be conducted on an inter-disciplinary basis.

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[26]J. J. Gruber, "Implications of Physical Education Programs for Children with Learning Disabilities," Journal of Learning Disabilities, 2, No. 11 (1969), 593-599.

[27]Ibid.

Cooperation with experts in special education, neurophysiology, sociology, psychology, and pharmacology is essential. It is Gruber's[28] notion that the role organized physical education and recreation programs play in developing IQ in mentally retarded children is not entirely conclusive. He suggests that those motor activities that require thought processes for execution do correlate to a higher degree with IQ than less complex activities. Hence, thought-provoking play activities may stimulate the development of independent reasoning by requiring the pupil to think through his movement patterns.

The present study was designed to draw upon some of the concepts of a number of the studies mentioned in this review. The Skubic and Anderson[29] study, with its modifications of the six PM tests, is extended to one high achieving group and three groups of low achieving, learning disabled groups. The Rourke, Young and Flewelling[30] study is extended to gross motor skills. The Rourke and Telegdy[31] study is

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[28] J. J. Gruber, "Implications of Physical Education Programs for Children with Learning Disabilities," Journal of Learning Disabilities, 2, No. 11 (1969), 593-599.

[29] Skubic and Anderson, loc. cit.

[30] Rourke, Young and Flewelling, loc. cit.

[31] Rourke and Teledgy, loc. cit.

extended to gross motor skills. The results of Biddulph,[32] Ismail and Gruber,[33] and Rarick and McGee[34] of moderate correlations between intelligence and various types of motor performance are sought to be confirmed by this study.

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[32]Biddulph, loc cit.

[33]Gruber, loc. cit.

[34]Rarick and McGee, loc. cit.

Chapter 3

METHODS AND PROCEDURES

This chapter will consider first a description of the subjects followed by a description of the perceptual-motor tests and the instruments. These will be followed by sections on collection of the data and analysis of the data.

DESCRIPTION OF SUBJECTS

Four groups of students were utilized that numbered 28, 26, 26, and 25 for groups one through four, respectively. The age of the subjects ranged from 8 to 14 years. The first three groups were determined by special placement (certification by a specialist as learning disabled and assigned to a special class) and by current school records to be low-achieving, learning disabled students. In this connection the minimum standards and regulations of the State of Tennessee, as pertains to special education, were adhered to. A fourth group consisted of high-achieving students, as determined by ratings by school personnel and school records, including present achievement at the 90th percentile on the

Metropolitan, Stanford, or Wide Range achievement tests. Both male and female subjects were used. The first three groups consisted of all of the available subjects, in each respective category, from two counties in the Upper Cumberland Region. The fourth group represented all of the available subjects for that category from a single county. The first group was designated as the high performance (HP) group (WISC performance superior to WISC verbal ability), the second the high verbal (HV) group (WISC verbal superior to WISC performance ability), and the third group was noted as the performance equals verbal (P=V) group whose WISC performance and verbal abilities yielded no significant differences.

The mean age, in months, for the 105 subjects was 126. The mean age, in months, for groups 1 through 4 was 127.9, 122.8, 121.8, and 123.8, respectively. The mean full scale intelligence quotient (FSIQ WISC) for all subjects was 95. The mean FSIQ(s) for groups 1 through 4 were 85.7, 84.3, 98.0 and 113.9, respectively. The mean difference between performance and verbal subtests (WISC) for the HP group was 17.1; and for the HV group, 16.8; and for the P=V group, 3.8.

PERCEPTUAL-MOTOR TESTS

The six perceptual-motor tests are described in some detail in Appendix A and are listed in order as (1) balance beam test, a measure of kinesthetic sense, gross motor coordination, and dynamic balance; (2) balance on right foot, a measure of static balance; (3) reaction time test, a measure of speed in making decisions and the reaction to that decision; (4) McCloy block test, simplified, a measure of cognitive ability, memory, fine motor coordination and perceptual speed; (5) side-slide test, a measure of agility, gross motor coordination; and (6) underhand throw, a measure of fine muscle control and eye-hand coordination.

While reliability and validity studies are not presently available for the PM tests, it should be noted that the rationale for these tests is not new. They are modifications and adaptations, of a slight nature, of other standard tests in common use by physical educators for many years.[1] Such changes are required because of the maturational level of the subjects. These tests have "face" validity in the sense that they appear to do what they are supposed to do.

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[1]Skubic and Anderson, loc. cit.

INSTRUMENTS

The WISC and/or WISC-R were used to help in the identification of the intellectual level of the students in the respective counties. These instruments, for the purposes of this study, are used interchangeably. High correlations between the instruments are reported by Gironda,[2] Swerdlik,[3] and Hartlage and Steele.[4] Anastasi[5] reports split-half reliability coefficients for each subtest of the WISC, as well as for verbal, performance, and full scale scores. These reliabilities were computed separately with the 7.5-, 10.5-, and 13.5-year samples, each age group consisting of 200 cases. The full scale reliabilities for the verbal scale are .88, .96, and .96. For the performance

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[2] R. J. Gironda, "A Comparison of WISC and WISC-R Results of Urban Educable Mentally Retarded Students," Psychology in the Schools, Vol. 14, No. 3 (1977), 271-275.

[3] M. E. Swerdlik, "The Question of the Comparability of the WISC and WISC-R: Review of the Research and Implications for School Psychologists," Psychology in the Schools, Vol. 14, No. 3 (1977), 260-270.

[4] I. C. Hartlage and C. T. Steele, "WISC and WISC-R Correlates of Academic Achievement," Psychology in the Schools, Vol. 14, No. 1 (1977), 15-18.

[5] A. Anastasi, Psychological Testing, 3rd ed. (New York: The MacMillan Company, 1968), 285-288.

scale they are .86, .89, and .90, respectively. Standard errors of measurement of the three intelligence quotients, at the three age levels investigated, range from 3.00 to 5.61 IQ points.

A number of studies have been conducted wherein measures of the WISC have been correlated with the results of other measures of intelligence or achievement. Robb, Bernardoni and Johnson[6] report studies of correlations between the WISC and other mental ability tests and these include those of Martin and Wischers,[7] Barratt,[8] Barclay and Carolan,[9] and others. With respect to reported correlations between the WISC and achievement tests, they report a number of studies which include those of Frandsen

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[6]G. P. Robb, L. C. Bernardoni, and R. W. Johnson, Assessment of Individual Mental Ability (Scranton: Intex Educational Publishers, 1972), 141-155.

[7]A. W. Martin and J. E. Wischers, "Raven's Colored Progressive Matrices and the Wechsler Intelligence Scale for Children," Journal of Consulting Psychology, 18 (1954), 143-144.

[8]E. S. Barratt, "The Relationship of the Progressive Matrices (1938) and the Columbia Mental Maturity Scale to the WISC," Journal of Consulting Psychology, 20 (1956), 294-296.

[9]A. Barclay and P. Carolan, "A Comparative Study of the Wechsler Intelligence Scale for Children and the Stanford-Binet Intelligence Scale, Form 1-M," Journal of Consulting Psychology, 30 (1966), 6, 563.

and Higginson,[10] Baumgarten,[11] and others. Numerous other studies concerning the validity of the WISC include those cited in Sattler[12] and Littel.[13] Littel reports that a number of independent investigators have found concurrent validity coefficients between WISC scores and achievement tests or other academic criteria of intelligence to cluster around .60.

The Bender Visual-Motor Gestalt Test was in current use in the respective counties involved in this study. Pascal and Suttell[14] have standardized and quantified this test on an adult population. Cross validation of a devised scoring key on new samples of 474 nonpatients, 187 neurotics,

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[10] A. N. Frandsen and J. B. Higginson, "The Stanford-Binet and the Wechsler Intelligence Scale for Children," Journal of Consulting Psychology, 15 (1951), 236-238.

[11] D. L. Baumgarten, "The Relationship of the WISC and Stanford Binet to School Achievement," Journal of Consulting Psychology, 21 (1957), 144.

[12] J. W. Sattler, Assessment of Children's Intelligence (Philadelphia: W. B. Saunders Co., 1974), 425-427.

[13] M. Littel, "The Wechsler Intelligence Scale for Children: Review of a decade of Research," Psychological Bulletin, 57 (1960), 132-156.

[14] G. R. Paschal and B. J. Suttell, "The Bander-Gestalt Test: Quantification and Validity for Adults (New York: Grune and Stratton, 1951).

and 136 psychotics yielded a distribution that clearly differentiates the psychotics and neurotics from the controls, the mean scores of the three groups being 81.8, 68.2, and 50, respectively. These scores are standard scores with a mean of 50 and a standard deviation of 10, the higher scores indicating more diagnostic errors. The biserial correlation of test scores against the criterion of patient versus nonpatient status is .74. The correlation may be regarded as a measure of concurrent criterion-related validity.[15] Tolor and Schulberg[16] find that this adaptation of the test can significantly differentiate groups of organics from both normal and psychotic groups. Koppitz[17] reports fairly high validities for the Bender-Gestalt Test in assessing school readiness and in predicting the subsequent educational achievement of first-grade children. Koppitz also gives evidence that suggests that among mentally retarded children the Bender-Gestalt developmental score has fairly high

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[15]Anastasi, op. cit., pp. 303-307.

[16]A. Tolor and H. C. Schulberg, An Evaluation of the Bender-Gestalt Test (Springfield, Ill.: Charles C. Thomas Co., 1963).

[17]E. M. Koppitz, The Bender Gestalt Test for Young Children (New York: Grune and Stratton, 1964).

validity as a measure of intellectual level and as a predictor of academic achievement.

With respect to the reliability of the Bender-Gestalt Test, Anastasi[18] states that retest reliabilities of about .70 were found in normal samples over a 24-hour interval. Scorer reliabilities of approximately .90 are reported for trained scorers. She finds that this test, although used for a wide variety of testing purposes to be largely "unproven" in so far as validity is concerned. Recently, Larsen, Rogers and Sowell[19] investigated the usefulness of some commonly used tests of perceptual functioning. Two groups were administered the Auditory and Visual Sequential Memory and Sound Blending subtests of the Illinois Test of Psycholinguistic Abilities, the Wepman Auditory Discrimination Test and the Bender Visual-Motor Gestalt Test. They found that only the Bender test differentiated the two groups.

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[18]Anastasi, op. cit., p. 305.

[19]S. C. Larsen, D. Rogers, and V. Sowell, "The Use of Selected Perceptual Tests in Differentiating between Normal and Learning Disabled Children," Journal of Learning Disabilities, 9, No. 2 (1976), 85-90.

The Pupil Rating Scale, devised by Myklebust,[20] was used in the identification of the learning disabled students in the respective counties included in this study. Substantial correlations are reported for this scale and intelligence and educational achievement. The lowest intercorrelations by item are related to motor coordination. Except for this area of behavior, intercorrelations among the items are rather high and range from .79 to .90. It should be noted that this scale was designed to indicate the level of learning effectiveness, not learning potential, and the ratings reflect success in learning rather than intellectual capacity. Since the scale is reported to show the greatest relationship with educational achievement[21] in reading, spelling, and arithmetic, it seems particularly relevant to this study and to the evaluation of the learning disabled primary student. The scale, however, suffers from the various weaknesses of rating scales. Anastasi[22] states

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[20] H. R. Myklebust, The Pupil Rating Scale (New York: Grune and Stratton, 1971).

[21] Ibid.

[22] Anastasi, op. cit., p. 420.

that such rating scales are subject to a number of constant errors such as the "halo effect," "error of central tendency," and "leniency error."

COLLECTION OF DATA

Permission to conduct the study and to collect the data was received by the writer from the respective superintendents of schools of the counties involved.

Six perceptual-motor tests (see Appendix A) were administered to four groups of elementary students who were primarily at the fourth grade level. The tests were administered in the spring of 1976 by the writer and selected assistants to the students in two counties of the Upper Cumberland Region of the State of Tennessee. The data were collected over a period of forty-five days. Additional data were gathered from school records within the same period of time. The four groups were divided according to verbal and performance ability (WISC). Each student was administered either the WISC or WISC-R, the Bender Visual-Motor Gestalt Test and the Myklebust Pupil Rating Scale in addition to the perceptual-motor tests. A special tally sheet (see Appendix B) was devised in order to facilitate the collection of data.

ANALYSIS OF DATA

An analysis of variance was conducted to determine if data reached a significant F test. The Duncan Multiple Range Test was employed to determine between group difference for data yielding significant F tests. The Fisher t-test was used to determine if mean scores between the four groups and the six perceptual-motor tests reached statistical significance. The .05 level of significance was accepted.

The relevant data from the special tally sheet were analyzed by the use of the Wherry-Doolittle method of multiple regression to determine correlations and multiple predictors.

For category No. 15, tally sheet, environmental disadvantage, relevant school personnel were asked--at a conference--to rate the child's environmental status as it was compared to other family situations in the same locale. Each child was rated as (1) no disadvantage, (2) some disadvantage, or as (3) substantial disadvantage. For category No. 13, achievement scores, the rank of one signified a stanine score from six through nine. The rank of two signified a stanine score from 4.0 to 5.9. The rank of three signified a stanine score between 2.0 and 3.9. The rank of four represented a stanine score of 1.9 or below.

Chapter 4

RESULTS

Data that concern the Wherry data for PM tests one through six are considered first in this section. This is followed by the *t*-test, analysis of variance, and Duncan Multiple Range Test data, respectively. The VARN correlation data is then shown and, lastly, the groups are compared with respect to the hypotheses.

Tables 1 and 2 pertain to the Wherry data for criterion one (balance beam, PM Test 1). Table 1 depicts the mean and standard deviation for all subjects on the PM tests. Table 2 supplies the correlations and intercorrelations of all subjects on all variables for PM Test 1. Table 2 gives the beta coefficients, regression coefficients, and the multiple correlation coefficients for all subjects on PM Test 1. These tables together with Table 3 find PM Test 1 to be related to multiple predictors (28, 5, 23, 20, 19 and 26) membership in Group HV, Myklebust rating of motor ability, WISC picture arrangement, WISC verbal comprehension, WISC arithmetic, and female sex respectively. The multiple

Table 1

Mean and Standard Deviation Scores

for PM Tests 1 through 6

	Mean	Sigma
PM 1	37.8	15.7
PM 2	24.2	18.6
PM 3	30.7	9.3
PM 4	26.4	10.5
PM 5	4.8	1.2
PM 6	8.4	3.1
1. Bender errors	7.2	8.0
2. Myklebust total	69.9	17.7
3. Myklebust auditory	11.1	4.0
4. Myklebust spoken language	13.7	4.0
5. Myklebust motor	9.4	2.1
6. Myklebust orientation	12.4	3.8
7. Myklebust personal-social	23.6	6.1
8. Myklebust socio-economic	4.6	2.0
9. Environmental disadvantage	1.7	0.7
10. Family size	5.8	2.6
11. Grade level	3.8	0.8
12. Age, months	126.0	13.6
13. Achievement	2.4	1.0
14. WISC FSIQ	95.1	15.5
15. WISC verbal	96.3	15.8
16. WISC performance	94.4	16.5
17. WISC information	8.6	3.0
18. WISC similarities	10.2	3.3
19. WISC arithmetic	9.7	3.0
20. WISC verbal comprehension	10.0	3.8
21. WISC digit span	8.6	2.7
22. WISC picture completion	9.4	3.2
23. WISC picture arrangement	8.6	3.4
24. WISC block design	9.0	2.7

Table 1 (cont'd)

	Mean	Sigma
25. WISC coding	9.8	2.8
26. Female sex	1.3	0.4
27. HP group	0.2	0.4
28. HV group	0.2	0.4
29. P=V group	0.2	0.4
30. HA group	0.2	0.4
31. Koppitz errors	5.0	3.6

Table 2

Beta, Regression, and Multiple Correlation

Coefficients PM Test 1 (Balance Beam)

Percentage contribution to variance of criterion by each test

28	5	23	20	19	26
26.15	11.24	-4.69	2.58	-0.30	1.89

Beta coefficients

28	5	23	20	19	26
-0.54	0.31	-0.19	0.24	-0.20	0.10

Regression coefficients

constant	28	5	23	20	19	26
24.9147	-19.7136	2.2976	-0.8898	0.9651	-0.0512	3.1440

Uncorrected multiple correlation coefficient = 0.6071

Corrected multiple correlation coefficient = 0.5802

Standard error of estimate = 12.8620

Table 3

The Incidence of Significant Multiple Predictors

for All Perceptual Motor (PM) Tests

	PM 1	PM 2	PM 3	PM 4	PM 5	PM 6
1. Bender errors		+				
2. Myklebust total						
3. Myklebust auditory					+	
4. Myklebust spoken language			-			
5. Myklebust motor	+	+	-	-	+	+
6. Myklebust orientation				-		
7. Myklebust personal-social						
8. Socio-economic level				-		
9. Environmental disadvantage				+		-
10. Family size					+	
11. Grade level		+		-	+	
12. Age in months			-			
13. Achievement		+	-			
14. WISC full scale		+	-	-		
15. WISC verbal			-			
16. WISC performance		+	-			
17. WISC information						
18. WISC similarities			-			
19. WISC arithmetic	+	+				
20. WISC verbal comprehension	+			-		
21. WISC digit span						
22. WISC picture completion				-		
23. WISC picture arrangement	+			-		
24. WISC block design						
25. WISC coding						+
26. Female sex	+			-		
27. HP group membership		-			+	
28. HV group membership	-		+			-
29. HPHV group membership P=V			+			-
30. HA group membership			-			
31. Koppitz errors			+			

+ = positive correlation
- = negitive correlation

correlation coefficient of .58 is shown for PM Test 1 in Table 2 which also finds the best predictors to be HV group membership (28) and Myklebust motor ability (5).

Similarly, Table 4 is Wherry data for Criterion 2 (balance on right foot, PM Test No. 2) and this table, together with Table 3, depicts PM Test 2 to relate to multiple predictors (16, 11, 13, 5, 19, 14, 1 and 27) WISC total performance, grade level, achievement, Myklebust rating of motor ability, WISC arithmetic, WISC full scale score, Bender errors and membership in the HP group respectively. The best predictor is shown to be WISC FSIQ (14) and Table 4 shows the multiple correlation coefficient to be .49.

In like manner, Table 5 as well as Table 3 refer to Wherry data for Criterion 3 (reaction time, PM Test No. 3). The best predictors for PM Test 3 are noted to be predictors 28, 12, 2, 29, 13, 15, 31, 5, 16 and 14 (membership in the HV group, age, Myklebust total rating, P=V group membership, achievement, WISC verbal scores, Koppitz errors, Myklebust rating of motor ability, WISC performance scores, and WISC full scale score, respectively). Table 5 reveals the best predictors for PM Test 3 to be HV group membership (28) and WISC FSIQ (14) and the multiple correlation coefficient is shown to be .67.

Table 4

Beta, Regression, and Multiple Correlation Coefficients

for PM Test 2 (Balance on Right Foot)

Percentage contribution to variance of criterion by each test

16	11	13	5	19	14	1	27
-2.35	4.49	5.68	3.47	-5.92	24.31	0.26	-0.28

Beta coefficients

16	11	13	5	19	14	1	27
-0.05	0.19	0.17	0.13	-0.29	0.57	0.11	0.15

Regression coefficients

Constant	16	11	13	5	19	14	1	27
-56.1978	-0.0608	4.4495	3.2085	1.0919	-1.7898	0.6802	0.2535	6.5148

Uncorrected multiple correlation coefficient = 0.5446

Corrected multiple correlation coefficient = 0.4958

Standard error of estimate = 16.2294

Table 5

Beta, Regression, and Multiple Correlation Coefficients

for PM Test 3 (Reaction Time)

Percentage contribution to variance of criterion by each test

28	12	2	29	13	15	31	5	16	14
28.79	3.37	7.37	2.68	-6.22	-6.23	-3.42	3.71	-26.74	41.18

Beta coefficients

28	12	2	29	13	15	31	5	16	14
0.65	-0.33	-0.21	0.32	0.36	0.25	0.14	-0.12	0.77	-0.16

Regression coefficients

Constant	28	12	2	29	13	15	31	5
71.8455	14.0007	-0.2268	-0.1084	6.8978	3.3065	0.1476	-0.3566	-0.5361

16	14
0.4356	0.7016

Uncorrected multiple correlation coefficient = 0.7106

Corrected multiple correlation coefficient = 0.6768

Standard error of estimate = 6.8924

Table 6 refers to the Wherry data for criterion 4 (McCloy block test, PM Test No. 4) and, together with Table 3, shows PM Test 4 to be related to predictors 14, 26, 11, 5, 20, 22, 9, 6, 8 and 23 (WISC full scale score, female sex, grade level, Myklebust rating of motor ability, WISC verbal comprehension, WISC picture completion, environmental disadvantage, Myklebust orientation rating, socio-economic level and WISC picture arrangement). Table 6 reveals the best predictor to be 14 (WISC FSIQ) and the multiple correlation coefficient to be .70.

Table 7 refers to Wherry data for Criterion 5 (side-slide test, PM Test No. 5) and this, together with Table 3, indicates PM Test 5 to be related to predictors 3, 27, 11, 5 and 10 (Myklebust auditory rating, HP group membership, grade level, Myklebust rating of motor ability and family size, respectively). Table 7 reveals the best predictor to be Myklebust auditory and the multiple correlation coefficient to be .43.

Table 8 refers to Wherry data for Criterion 6 (underhand throw, PM Test No. 6) and, together with Table 3 indicates the best predictors for PM Test 6 to be 28, 9, 5, 29, and 25 (HV group membership, environmental disadvantage, Myklebust rating of motor ability, P=V group, and WISC coding

Table 6

Beta, Regression, and Multiple Correlation Coefficients

for PM Test 5 (McCloy Blocks Test Simplified)

Percentage contribution to variance of criterion by each test

14	26	11	5	20	22	9	6	8	23
20.67	10.70	5.47	7.15	-6.29	-4.51	7.84	8.25	-3.70	8.76

Beta coefficients

14	26	11	5	20	22	9	6	8	23
-0.40	-0.26	-0.17	-0.19	0.32	0.17	0.24	-0.18	0.17	-0.17

Regression coefficients

Constant	14	26	11	5	20	22	9	6
63.5937	-0.2732	-5.8145	-2.1634	-0.9121	0.8880	0.5705	3.4767	-0.5008

8	23
0.8544	-0.5263

Uncorrected multiple correlation coefficient = 0.7372
Corrected multiple correlation coefficient = 0.7073
Standard error of estimate = 7.4632

Table 7

Beta, Regression, and Multiple Correlation

Coefficients for PM Test 5 (Side Slide)

Percentage contribution to variance of criterion by each test

3	27	11	5	10
12.61	1.31	4.50	3.12	0.47

Beta coefficients

3	27	11	5	10
0.37	0.24	0.20	0.11	0.10

Regression coefficients

Constant	3	27	11	5	10
1.2014	0.1178	0.6983	0.3179	0.0682	0.0486

Uncorrected multiple correlation coefficient = 0.4692

Corrected multiple correlation coefficient = 0.4347

Standard error of estimate = 1.1634

Table 8

Beta, Regression, and Multiple Correlation Coefficients

for PM Test 6 (Underhand Throw)

Percentage contribution to variance of criterion by each test

28	9	5	29	25
19.54	7.40	4.59	1.45	-1.12

Beta coefficients

28	9	5	29	25
-0.46	-0.23	0.20	-0.19	-0.17

Regression coefficient

Constant	28	9	5	29	25
10.4739	-3.3341	-1.0021	0.2921	-1.3594	-0.1856

Uncorrected multiple correlation coefficient = 0.5819

Corrected multiple correlation coefficient = 0.5587

Standard error of estimate = 2.6000

score, respectively). Table 8 shows the best predictor to be 28 (HV group membership) and the multiple correlation coefficient to be .55.

Table 3 indicates that the most consistent predictor of all PM test scores is the Myklebust rating of motor ability. The next most consistent predictors are membership in HV group and WISC FSIQ.

Tables 9, 10, 11 and 12 show the results for the *t*-test, analysis of variance, Duncan Multiple Range Test and the correlation data respectively. Table 9 indicates significant differences between groups HA and HP on PM Tests 2, 3, 4 and 5. Similarly, Table 9 reveals significant differences for all PM tests when comparing the HV and HA groups. Additionally, Table 9 shows the HA group to differ significantly from the P=V group on PM Tests 3, 4, 5 and 6 respectively. Further, Table 9 reveals significant differences on PM Tests 1, 2, 3 and 6 for the HP and HV groups. The table also shows the HP group to differ significantly from the P=V group on PM Test 6. Table 9 shows the P=V group to score significantly better than the HV group on PM Tests 1, 2, 3, 4 and 6.

Table 9

Significance of t values of PM Tests and Groups

PM Test	HP HV 1 vs 2	HP P=V 1 vs 3	HP HA 1 vs 4	HV P=V 2 vs 3	HV HA 2 vs 4	P=V HA 3 vs 4
1. Balance beam	4.00***	-.27	-.72	-5.36***	-6.58***	-.528
2. Balance on right foot	2.64*	-.10	-2.09*	-2.64*	-4.19***	-1.97
3. Reaction time	-3.96***	-1.80	2.29*	2.24*	5.88***	3.95***
4. McCloy blocks simplified	-1.71	1.06	5.40***	2.79**	6.7***	4.89***
5. Side-slide	1.25	1.95	-2.73**	-.26	-2.47*	-4.50
6. Underhand throw	4.63***	2.1*	-.52	-2.48*	-4.88***	-2.55*

* p .05
** p .01
*** p .001

Table 10

Analysis of Variance for One-way Design

	Sum of Squares	df	Mean Square	F Ratio	p
PM 1					
Between groups	6168.7734	3	2056.2578	10.5056**	.01
Within groups	19768.7886	101	195.7306		
Total	25937.5620	104			
PM 2					
Between groups	5748.4623	3	1916.1541	6.3302	.01
Within groups	30572.5283	101	302.6983		
Total	36320.9907	104			
PM 3					
Between groups	2531.3892	3	843.7964	12.9439	.01
Within groups	6584.0394	101	65.1885		
Total	9115.4287	104			
PM 4					
Between groups	3424.7000	3	1141.5667	14.1201	.01
Within groups	8165.5477	101	80.8470		
Total	11590.2477	104			
PM 5					
Between groups	17.5499	3	5.8500	3.7872*	.05
Within groups	156.0120	101	1.5447		
Total	173.5619	104			
PM 6					
Between groups	239.0324	3	79.6775	10.2774	.01
Within groups	783.0247	101	7.7527		
Total	1022.0571	104			

*p of .05 = 2.70 **p of .01 = 3.98

Table 11

Duncan Multiple Range Test Results between

PM Tests and Group Combinations

PM Test	HP HV 1 vs 2	HP P=V 1 vs 3	HP HA 1 vs 4	HV P=V 2 vs 3	HV HA 2 vs 4	P=V HA 3 vs 4
1. Balance beam	s.	n.s.	n.s.	s.	s.	n.s.
2. Balance on right foot	n.s.*	n.s.	s.	n.s.*	s.	s.**
3. Reaction time	s.	n.s.	n.s.*	s.	s.	s.
4. McCloy blocks simplified	s.**	n.s.	s.	s.	s.	s.
5. Side-slide	n.s.	n.s.	n.s.*	n.s.	s.	s.
6. Underhand throw	s.	s.	n.s.	s.	s.	s.

*This cell found to be significant with _t_-test
**This cell found to fail to reach significance with _t_-test

Table 12

Correlations Among Selected Variables

	Correlation	t-score
Bender errors (1)		
Myklebust total (2)	-0.13	-1.34
Myklebust auditory (3)	-0.07	-0.76
Myklebust spoken language (4)	-0.15	-1.60
Myklebust motor (5)	-0.09	-0.96
Myklebust orientation (6)	0.40	4.54
Myklebust personal-social (7)	-0.43	-4.93
Family size (8)	0.05	0.53
Achievement (9)	-0.05	-0.54
WISC full scale (10)	-0.07	-0.77
WISC verbal (11)	-0.05	-0.54
WISC performance (12)	-0.08	-0.86
WISC information (13)	-0.10	-0.02
WISC similarities (14)	0.05	0.51
WISC arithmetic (15)	0.01	0.11
WISC verbal comprehension (16)	-0.02	-0.27
WISC digit span (17)	-0.15	-1.56
WISC picture completion (18)	-0.03	-0.40
WISC picture arrangement (19)	-0.05	-0.60
WISC block design (20)	-0.19	-1.97
WISC coding (21)	0.00	0.03
Koppitz errors (22)	0.13	1.27
Myklebust total (2)		
Myklebust auditory (3)	0.90	22.07
Myklebust spoken language (4)	0.89	20.55
Myklebust motor (5)	0.62	8.20
Myklebust orientation (6)	0.75	11.76
Myklebust personal-social (7)	0.84	16.30
Family size (8)	-0.18	-1.86
Achievement (9)	0.74	11.35
WISC full scale (10)	0.63	8.30

Table 12 (cont'd)

	Correlation	t-score
WISC verbal (11)	0.66	8.95
WISC performance (12)	0.43	4.96
WISC information (13)	0.65	8.68
WISC similarities (14)	0.32	3.43
WISC arithmetic (15)	0.62	8.04
WISC verbal comprehension (16)	0.53	6.45
WISC digit span (17)	0.49	5.76
WISC picture completion (18)	0.34	3.76
WISC picture arrangement (19)	0.43	4.96
WISC block design (20)	0.26	2.81
WISC coding (21)	0.27	2.90
Koppitz errors (22)	-0.53	-6.00
Myklebust auditory (3)		
Myklebust spoken language (4)	0.87	18.73
Myklebust motor (5)	0.51	6.09
Myklebust orientation (6)	0.75	11.77
Myklebust personal-social (7)	0.75	11.59
Family size (8)	-0.20	-2.10
Achievement (9)	0.74	11.30
WISC full scale (10)	0.68	9.50
WISC verbal (11)	0.70	10.11
WISC performance (12)	0.49	5.75
WISC information (13)	0.72	10.63
WISC similarities (14)	0.33	3.54
WISC arithmetic (15)	0.66	9.03
WISC verbal comprehension (16)	0.56	6.91
WISC digit span (17)	0.52	6.19
WISC picture completion (18)	0.38	4.25
WISC picture arrangement (19)	0.46	5.27
WISC block design (20)	0.31	3.37
WISC coding (21)	0.30	3.19
Koppitz errors (22)	-0.56	-6.55

Table 12 (cont'd)

	Correlation	t-score
Myklebust spoken language (4)		
Myklebust motor (5)	0.49	5.80
Myklebust orientation (6)	0.70	10.12
Myklebust personal-social (7)	0.71	10.39
Family size (8)	-0.23	-2.47
Achievement (9)	0.76	11.91
WISC full scale (10)	0.66	8.93
WISC verbal (11)	0.71	10.27
WISC performance (12)	0.42	4.74
WISC information (13)	0.70	10.12
WISC similarities (14)	0.36	4.03
WISC arithmetic (15)	0.63	8.37
WISC verbal comprehension (16)	0.58	7.27
WISC digit span (17)	0.51	6.03
WISC picture completion (18)	0.35	3.89
WISC picture arrangement (19)	0.44	5.07
WISC block design (20)	0.30	3.20
WISC coding (21)	0.19	2.02
Koppitz errors (22)	-0.46	-5.08
Myklebust motor (5)		
Myklebust orientation (6)	0.45	5.17
Myklebust personal-social (7)	0.51	6.06
Family size (8)	-0.04	-0.50
Achievement (9)	0.42	4.74
WISC full scale (10)	0.36	3.95
WISC verbal (11)	0.30	3.29
WISC performance (12)	0.30	3.21
WISC information (13)	0.25	2.68
WISC similarities (14)	0.07	0.78
WISC arithmetic (15)	0.30	3.30
WISC verbal comprehension (16)	0.28	3.07
WISC digit span (17)	0.29	3.14

Table 12 (cont'd)

	Correlation	t-score
WISC picture completion (18)	0.26	2.75
WISC picture arrangement (19)	0.43	4.87
WISC block design (20)	0.19	2.05
WISC coding (21)	0.15	1.57
Koppitz errors (22)	-0.28	-2.84
Myklebust orientation (6)		
Myklebust personal-social (7)	0.43	4.92
Family size (8)	-0.23	-2.44
Achievement (9)	0.66	9.11
WISC full scale (10)	0.61	7.94
WISC verbal (11)	0.63	8.29
WISC performance (12)	0.41	4.65
WISC information (13)	0.58	7.28
WISC similarities (14)	0.38	4.27
WISC arithmetic (15)	0.61	7.89
WISC verbal comprehension (16)	0.52	6.22
WISC digit span (17)	0.38	4.28
WISC picture completion (18)	0.31	3.39
WISC picture arrangement (19)	0.46	5.29
WISC block design (20)	0.24	2.59
WISC coding (21)	0.26	2.82
Koppitz errors (22)	-0.45	-4.84
Myklebust personal-social (7)		
Family size (8)	-0.08	-0.84
Achievement (9)	0.60	7.71
WISC full scale (10)	0.46	5.29
WISC verbal (11)	0.48	5.60
WISC performance (12)	0.34	3.78
WISC information (13)	0.50	5.91
WISC similarities (14)	0.20	2.07
WISC arithmetic (15)	0.48	5.59
WISC verbal comprehension (16)	0.37	4.07
WISC digit span (17)	0.38	4.26

Table 12 (cont'd)

	Correlation	t-score
WISC picture completion (18)	0.24	2.58
WISC picture arrangement (19)	0.27	2.93
WISC block design (20)	0.23	2.42
WISC coding (21)	0.23	2.44
Koppitz errors (22)	-0.44	-4.80
Family size (8)		
Achievement (9)	-0.24	-2.53
WISC full scale (10)	-0.27	-2.91
WISC verbal (11)	-0.25	-2.71
WISC performance (12)	-0.22	-2.31
WISC information (13)	-0.17	-1.80
WISC similarities (14)	-0.16	-1.71
WISC arithmetic (15)	-0.16	-1.72
WISC verbal comprehension (16)	-0.32	-3.54
WISC digit span (17)	-0.17	-1.78
WISC picture completion (18)	-0.20	-2.16
WISC picture arrangement (19)	-0.27	-2.92
WISC block design (20)	-0.13	-1.33
WISC coding (21)	-0.08	-0.87
Koppitz errors (22)	0.19	1.92
Achievement (9)		
WISC full scale (10)	0.64	8.49
WISC verbal (11)	0.68	9.49
WISC performance (12)	0.42	4.79
WISC information (13)	0.64	8.57
WISC similarities (14)	0.36	3.95
WISC arithmetic (15)	0.61	7.92
WISC verbal comprehension (16)	0.61	7.83
WISC digit span (17)	0.47	5.45
WISC picture completion (18)	0.28	3.06
WISC picture arrangement (19)	0.43	4.89

Table 12 (cont'd)

	Correlation	t-score
WISC block design (20)	0.30	3.23
WISC coding (21)	0.28	3.01
Koppitz errors (22)	-0.46	-5.04
WISC full scale (10)		
WISC verbal (11)	0.88	19.16
WISC performance (12)	0.48	15.80
WISC information (13)	0.81	14.11
WISC similarities (14)	0.67	9.27
WISC arithmetic (15)	0.75	11.59
WISC verbal comprehension (16)	0.67	9.18
WISC digit span (17)	0.55	6.76
WISC picture completion (18)	0.59	7.53
WISC picture arrangement (19)	0.72	10.69
WISC block design (20)	0.68	9.51
WISC coding (21)	0.59	7.53
Koppitz errors (22)	-0.55	-6.40
WISC verbal (11)		
WISC performance (12)	0.50	5.93
WISC information (13)	0.86	17.33
WISC similarities (14)	0.74	11.46
WISC arithmetic (15)	0.84	15.85
WISC verbal comprehension (16)	0.80	13.58
WISC digit span (17)	0.64	8.66
WISC picture completion (18)	0.34	3.77
WISC picture arrangement (19)	0.46	5.26
WISC block design (20)	0.40	4.54
WISC coding (21)	0.43	4.92
Koppitz errors (22)	-0.52	-5.84

Table 12 (cont'd)

	Correlation	t-score
WISC performance (12)		
WISC information (13)	0.53	6.39
WISC similarities (14)	0.38	4.22
WISC arithmetic (15)	0.42	4.82
WISC verbal comprehension (16)	0.34	3.73
WISC digit span (17)	0.30	3.22
WISC picture completion (18)	0.71	10.32
WISC picture arrangement (19)	0.79	13.35
WISC block design (20)	0.79	13.15
WISC coding (21)	0.59	7.53
Koppitz errors (22)	-0.40	-4.19
WISC information (13)		
WISC similarities (14)	0.59	7.57
WISC arithmetic (15)	0.72	10.70
WISC verbal comprehension (16)	0.60	7.78
WISC digit span (17)	0.47	5.46
WISC picture completion (18)	0.41	4.59
WISC picture arrangement (19)	0.39	4.39
WISC block design (20)	0.43	4.87
WISC coding (21)	0.43	4.88
Koppitz errors (22)	-0.46	-5.03
WISC similarities (14)		
WISC arithmetic (15)	0.49	5.76
WISC verbal comprehension (16)	0.54	6.60
WISC digit span (17)	0.28	2.96
WISC picture completion (18)	0.25	2.72
WISC picture arrangement (19)	0.33	3.59
WISC block design (20)	0.33	3.56
WISC coding (21)	0.36	3.99
Koppitz errors (22)	-0.32	-3.34

Table 12 (cont'd)

	Correlation	t-score
WISC arithmetic (15)		
WISC verbal comprehension (16)	0.56	6.87
WISC digit span (17)	0.56	6.92
WISC picture completion (18)	0.24	2.55
WISC picture arrangement (19)	0.44	4.97
WISC block design (20)	0.33	3.55
WISC coding (21)	0.40	4.51
Koppitz errors (22)	-0.46	-5.04
WISC verbal comprehension (16)		
WISC digit span (17)	0.34	3.72
WISC picture completion (18)	0.23	2.46
WISC picture arrangement (19)	0.38	4.20
WISC block design (20)	0.26	2.76
WISC coding (21)	0.25	2.62
Koppitz errors (22)	-0.35	-3.59
WISC digit span (17)		
WISC picture completion (18)	0.20	2.13
WISC picture arrangement (19)	0.26	2.79
WISC block design (20)	0.27	2.92
WISC coding (21)	0.27	2.90
Koppitz errors (22)	-0.42	-4.47
WISC picture completion (18)		
WISC picture arrangement (19)	0.46	5.37
WISC block design (20)	0.38	4.19
WISC coding (21)	0.22	2.35
Koppitz errors (22)	-0.20	-2.05

Table 12 (cont'd)

	Correlation	t-score
WISC picture arrangement (19)		
WISC block design (20)	0.63	8.30
WISC coding (21)	0.33	3.61
Koppitz errors (22)	-0.40	-4.27
WISC block design (20)		
WISC coding (21)	0.38	4.19
Koppitz errors	-0.32	-3.34
WISC coding (21)		
Koppitz errors (22)	-0.22	-2.18

Table 10 shows the analysis of variance data. Significant F ratios are noted for between group differences for all six PM tests.

Table 11 yields the Duncan Multiple Range Test data and significance is reached between HP and HV groups, HV and P=V groups, and HV and HA groups on PM Test 1. For PM Test 2, Table 11 reveals significant differences between HP and HA groups, HV and HA groups, and P=V and HA groups. Similarly, Table 11, for PM Test 3, shows significant differences between HP and HV groups, HV and P=V groups, HV and HA groups, and P=V and HA groups. Additionally, Table 11 for PM Test 4 shows significant differences between HP and HV groups, HP and HA groups, HV and P=V groups, HV and HA groups, and P=V and HA groups. Further, Table 11, for PM Test 5, shows significant differences between HV and HA groups and P=V and HA groups. Lastly, Table 13, for PM Test 6, reveals significant differences between HP and HV, HP and P=V, HV and HA, and P=V and HA groups.

Table 12--Correlations Among Selected Variables--shows WISC FSIQ to correlate with Koppitz Bender errors -.55, total Myklebust .63, Myklebust motor ability .36, and achievement .64. WISC VIQ correlates with Koppitz Bender errors -.52, total Myklebust .66, Myklebust motor ability .30 and

achievement .68. WISC PIQ is shown to correlate with Koppitz Bender errors -.40, total Myklebust .43, Myklebust motor ability .30 and achievement .42. Koppitz Bender errors are shown to correlate with total Myklebust -.53, Myklebust motor ability -.28 and achievement -.46. Myklebust total score is shown in Table 12 to correlate with Koppitz errors -.53, and achievement .74. Myklebust motor ability is shown to correlate with Koppitz Bender errors -.28 and achievement -.42.

In view of the results, Hypothesis 1 (the six PM tests were related to the educational success of the subjects of this study) was accepted since the six PM tests were related to the educational success of the subjects of this study. Thus, the HA group scored consistently higher than the low achieving HP, HV and P=V groups.

Similarly, Hypothesis 2 (within the intelligence range of the subjects of this study, a positive relationship existed between WISC FSIQ and each perceptual-motor test) was accepted. A positive relationship existed between FSIQ WISC and each PM test.

Hypothesis 3 (the HP, HV and P=V groups would exhibit a significantly lower performance score for the total battery of six PM tests than the HA group) was rejected since significant differences failed to occur on all six PM tests. Subhypotheses 3a, 3c, 3e and 3f were rejected (the hypothesis is applied to PM Tests 1, 3, 5 and 6 respectively). Subhypotheses 3b and 3d were accepted (the hypothesis is applied to PM Tests 2 and 4 respectively). Such data are shown in Table 11.

Similarly, Hypothesis 4 (the HV group would score significantly lower on the total battery of six PM tests than any other group) was rejected. Subhypotheses 4a, 4c and 4f were accepted (the hypothesis is applied to PM Tests 1, 3 and 6 respectively), and subhypotheses 4b, 4d and 4e were rejected (the hypothesis is applied to PM Tests 2, 4 and 5 respectively).

Hypothesis 5 (differences between the scores of the HP group and the P=V group would fail to reach significance for the total battery of six PM tests) is rejected as is subhypothesis 5f (the hypothesis is applied to PM Test 6). Subhypotheses 5a, 5b, 5c, 5d and 5e were accepted (the hypothesis is applied to PM Tests 1, 2, 3, 4 and 5 respectively).

Chapter 5

DISCUSSION AND APPLICATIONS

The results of this study support and extend the work of Skubic and Anderson[1] (1970). The extension is to low achieving, learning disabled groups of elementary students. Intelligence and academic achievement are found to relate to a battery of six perceptual-motor tests in four groups of elementary students of which three groups are learning disabled.

The results of Rourke, Young and Flewelling[2] (1971) are supported and that study is extended to gross motor perceptual skills. The present study forms a bridge that connects the aforementioned works and supports both.

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[1]V. Skubic and M. Anderson, "The Interrelationship of Perceptual-Motor Achievement, Academic Achievement and Intelligence of Fourth Grade Children," Journal of Learning Disabilities, 3, No. 8 (1970), 413-420.

[2]B. P. Rourke, G. C. Young, and R. W. Flewelling, "The Relationships between WISC Verbal-Performance Discrepancies and Selected Verbal, Auditory-Perceptual, Visual-Perceptual, and Problem-solving Abilities in Children with Learning Disabilities," Journal of Clinical Psychology, 27, No. 4 (1971), 475-479.

Certain perceptual-motor abilities do tend to relate positively to the achievement of learning disabled students who are primarily at the 4th or 5th grade level. The relatively HP student is found to score consistently higher on perceptual-motor tasks than the relatively HV student.

The learning disabled groups in the present study were divided in the same fashion as in the Rourke, Young and Flewelling[3] study except that 12 instead of 10 points was used between WISC PIQ and WISC VIQ. Field[4] finds a 12-point difference to be significant at the .05 level.

Certain perceptual-motor tests can be used to differentiate learning disabled students. Teachers and school psychologists could conceivably use such information to design individual education programs tailored to the specific needs of the individual student. It would seem a reasonable estimate to suggest that this battery of tests should also differentiate between high performance and high verbal regular class students, if so desired, who might also be separated into similar groups according to the criteria

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[3]Ibid.

[4]J. G. Field, "The Two Types of Tables for use with Wechsler's Intelligence Scales," Journal of Clinical Psychology, 16 (1960), 3-7.

herein. The six PM tests of this study appear to validate the idea of using WISC verbal and performance discrepancies in differentiating the HP student from the HV student.

Generally speaking, the pattern of the scores of this study suggests that gross visual-motor activities are more related to WISC Performance scores than to WISC Verbal scores. In this study, the group with the relatively low score on the six PM tests was also the group with the relatively low score on the WISC Performance items. Conversely, the HP group which did relatively well on WISC PIQ also did well on the six PM tests. Further, the HA group had the highest score on the six PM tests and also had the highest score on WISC PIQ.

The data appear to suggest that the reason the HA group was superior to the other groups was due to the strength of WISC PIQ rather than for WISC VIQ. It is further suggested that the reason for the superior performance by the HA group over the HP and P=V groups is explained by superior WISC PIQ rather than superior WISC VIQ. WISC performance subtests appear to be a reliable indicator and predictor of gross visual-motor abilities. Strength of performance (WISC) is suggested as the common denominator with respect to the PM tests of this study. For example, there is considerable

IQ difference between the HP (mean IQ 85.7) and P=V (mean IQ 98.0) yet to significant difference occurred in five of six PM tests. This points to the equated WISC PIQ ability as the determining factor. Thus, performance ability (WISC) appears to be the dominant factor in determining achievement on the six PM tests of this study rather than other factors such as verbal ability (WISC) or WISC FSIQ.

A hierarchy of perceptual-motor ability appears to exist, from the results of this study in the order of (1) HA group, (2) HP and P=V groups, and (3) HV group. This finding results from the consistent pattern that develops.

Although multiple _t_-test results are reported in Table 9, the interpretation of the results and discussion of the results refer to Table 17--Duncan Multiple Rante Test rather than to the _t_-test values. According to Hays[5] carrying out all _t_-tests between pairs of means is not a very satisfactory way to package the data for maximum clarity of results. Hays notes that the interpretation of such results is very difficult for the reason of lack of independence of the various comparisons tested. The groups are not independent. It is noted that results in Table 9 (_t_-test)

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[5]W. L. Hays, _Statistics for the Social Sciences_, 2nd ed. (Holt, Rinehart and Winston, Inc., 1973), p. 593.

are 77.7 percent significant whereas Table 11 (Duncan Multiple Range Test) reveals 72.2 percent significance.

The lack of high correlation between achievement and perceptual-motor ability suggests that other factors may intervene. Skubic and Anderson[6] (1970) state that the fact the correlation between achievement and perceptual-motor ability is high, but not higher, means that other factors are operating that affect academic pursuits. Lack of interest, emotional disturbance, and poor teaching may be some of the intervening factors. Their view is that teachers can, therefore, expect to find some low achievers who will have little or no difficulty in performing motor activities, and they will also find some high achievers who will not perform well. The writer would add additional factors such as various kinds and degrees of deprivation and disadvantage, poor planning as well as a lack of positive classroom instructional supervision as other intervening factors that may lower the correlation between achievement and perceptual-motor ability. Less than optimum measuring devices--used in this study--may be an additional factor.

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[6]Skubic and Anderson, loc. cit.

This study confirms the general finding of Skubic and Anderson[7] (1970) that the low achieving--particularly those with low WISC PIQ--students performed poorly on the PM tests while the opposite was true for the high achieving students. What are the implications of such findings with respect to remediation procedures? If a learning problem exists or if substantial perceptual-motor deficits exist, then a deficit in WISC PIQ of approximately one or more standard deviations--15 points--may point to a need of perceptual-motor remedial classes. Such remediation, it is suggested, should integrate gross visual-motor perceptual skills with gross audio-visual-motor perceptual abilities in a planned program of movement education. Such a program should be designed to provide meaning and purpose to gross motor activities and should allow for progression to fine motor audio and visual perceptual skills. Pairing these with kinesthetic experiences may be desirable.

According to Table 6, the results of the McCloy Blocks test, simplified, fell in the hypothesized direction in each of the six group comparisons. This suggests that this particular perceptual-motor test--measuring cognitive ability, short term memory, fine motor coordination and perceptual speed--more clearly differentiates the groups

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[7]Ibid.

than any other PM test. It further suggests that perhaps exercises designed to improve the areas noted above may be used positively as remediation activities. PM Test 3--reaction time test, a measure of speed in making decisions and the reaction to that decision--and PM Text 6--underhand throw, a measure of fine muscle control and eye-hand coordination--are also shown in Table 11 to reach significance in 4 of 6 group combinations (see Table 11, row 3 and two 6). This suggests that perhaps this combination of specific abilities measured by these three PM tests--3, 4, and 6--may serve to provide the best remediation opportunity for learning disabled elementary students with depressed performance ability (WISC). There is clearly a need for more research in this area and particularly with the gross and fine motor aspects of audio-perceptual skills. It may be possible that the learning disabled HP student may need audio-perceptual gross and fine motor remediation as the learning disabled HV student may need remediation in gross and fine visual-motor perceptual skills.

The moderate to substantial correlations of the WISC FSIQ, VIQ and PIQ in Table 8 with the total Myklebust rating suggests substantial reliability of the ratings performed by the teachers in this study. Thus, this table and Table 3 point to a fairly strong relationship between measured verbal and performance intellectual function with total Myklebust rating (.63). The strongest relationship is noted in Table 3 to be with the Myklebust rating of motor ability and significance is noted for all of the 6 PM tests of this study. The -.55 correlation (Table 8) between WISC FSIQ and Koppitz errors indicates that bender errors decline as intelligence increases. High intelligence is related to high Myklebust ratings. The probability of high Myklebust ratings increases as intelligence increases. Similarly, the probability of high rank on achievement increases as intelligence increases (correlation .64). It would seem reasonable that the Koppitz Bender errors would relate more strongly to WISC PIQ than VIQ. The respective correlations, however, of -.40 and -.52 indicate the likelihood of fewer Bender errors as both WISC PIQ and VIQ increase. A high rating on the Myklebust total and a high rank on achievement increases the probability of a high WISC PIQ or VIQ score. Low number of Koppitz bender errors increases the likelihood of a high rating/rank on Myklebust total rating or motor ability and achievement. Interestingly, a high score on the Myklebust rating of motor ability, while increasing the likelihood (-.28) of a low number of Bender errors, also increases the probability (-.42) of a low rank on achievement. Thus, the teachers who rank a child high on motor ability tend to rank the child low for achievement. In this connection, it should be remembered that one-fourth of the subjects constituted the HP group. This group was noteworthy of relatively high visual and visual-motor ability and a relatively low verbal ability. Since verbal ability (WISC VIP) is more generally equated with academic achievement, it should be realized that this was actually an expected result. Additionally, it should be emphasized that the HV group--relatively high on achievement (WISC VIQ) and low relatively on visual or visual-motor ability (WISC PIQ)--was also similarly ranked/rated by the teachers as relatively high in achievement and relatively low in motor ability. Hence about one-half of the subjects of this study--HP and HV groups--work in concert to influence this interesting finding. While Table 3 shows the Myklebust rating of motor ability to be significantly related to all 6 PM tests of this study, Table 8 shows this motor ability rating to actually decrease the probability of a high rank on achievement. However, high achievement is related to a high performance on the PM tests. This seeming discrepancy is explained as the data is examined to find one-half of the subjects (HP and HV groups) working together to influence such a finding for the Myklebust rating motor ability. Such a finding becomes obscured when such data is included as part of the total Myklebust rating. Although WISC FSIQ is related to achievement--a high score on WISC FSIQ increases the likelihood of a high rank on achievement--and WISC FSIQ is also related to total Myklebust score--a high score on WISC FSIQ increases the probability of a high Myklebust score--when a specific item from the Myklebust is removed and considered alone--such as the rating of motor ability--then the interesting development ensues that finds Myklebust rating of motor ability to be related positively to achievement on all of the 6 PM tests of this study yet to be negatively related to ranking on academic achievement. A high score on Myklebust rating of motor ability increases the likelihood of a high score on all 6 PM tests of this study but decreases the likelihood of a high rank on academic achievement. Such a finding is influenced by the various learning disabled groups included in this study. Half of the subjects of this study (HP and HV groups) were rated relatively high or low in either Myklebust motor or auditory ability. Another learning disabled group (P=V group) was ranked or rated low in achievement as well as relatively low for Myklebust auditory ability which is generally equated with low academic ability.

It should be noted that this study, which focused on gross and fine motor skills, reinforces the views of Rourke, Young and Flewelling,[8] Rourke and Teledgy,[9] that noted the high performance-low verbal student to be consistently superior to the high verbal-low performance student, at the 4th or 5th grade level, on measures that primarily involve visual-perceptual skills (e.g., visual discrimination and alertness, visual memory and spatial visualization). The high verbal-low performance student is superior to the high performance-low verbal student on measures of verbal abilities and auditory-perceptual skills (e.g., phonics, auditory memory, discrimination and sequencing). Such results seem to provide some basis for the fairly common practice[10]--in some areas--of referring to HP students as "visual learners," and to the high verbal ability student as "auditory learners." Such terms may be said to be descriptive

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[8]Rourke, Young and Flewelling, loc. cit.

[9]Rourke and Teledgy, loc. cit.

[10]P. H. Mann and P. Suiter, Handbook in Diagnostic Teaching: A Learning Disabilities Approach (Boston: Allyn and Bacon, 1974), pp. 2-3.

of as well as a euphemistic way of referring to a specific subject's "open channel." This term is derived from Anne Sullivan's usage in signifying that Helen Keller was found to be able to learn through her hands--or through the tactual sense. Perhaps it may be stated that to the extent that the various measures of visual-perceptual skills--including the WISC performance and/or verbal subtests--actually measure such an ability area, visual or auditory, the user of such an appellation may do so with a modest degree of confidence. The writer suggests that such students, learning disabled or not, are normally distributed within the school population, and the total population.

APPENDIX

Appendix A

The Six Perceptual-Motor Tests

1. Balance beam test. The equipment consists of four beams six feet long and from one-half inch to two inches in width. The beams are four inches off the ground. The participant will walk in heel-toe fashion progressing from the widest beam to the narrowest one until balance is lost. His/her score is determined from the best of two trials. This test is believed to measure kinesthetic sense, gross motor coordination and dynamic balance and demonstration test is performed by the experimenter.

2. Balance on right foot. The participant will balance on his/her right foot with eyes closed and hands on hips. The score is the number of seconds he/she can stand without his/her left foot touching the floor. This test is a measure of static balance and demonstration test is performed by the experimenter.

3. Reaction time. A ruler is dropped (in a prescribed manner) between the thumb and first index finger. The score is recorded as the approximate spot on the ruler that is caught. For reaction time, two rulers are used, one for each hand, then scored appropriately. This score is added to the above scores to arrive at the total score for reaction time. This test measures the speed in making decisions and the reaction to the decision.

4. McCloy Block Test (simplified). The equipment consists of 16 blocks (three inches square) arranged in two rows on a table. The color on top of the block is different from that on the bottom. As the first block is turned over, the bottom color gives the clue as to which block to pick up next according to a memorized sequence of colors. The score is the speed with which the participant can manipulate the blocks in sequence by using rapidly presented color cues. This test measures cognitive ability, short term memory, fine motor coordination and perceptual speed.

5. <u>Side-Slide test</u>. Two lines are placed eight feet apart. The participant takes a center position and when ready begins taking sliding steps first to one line and then the other but as fast as possible. The score is the number of times the participant crosses the center line in twelve seconds. This test measures agility, gross motor coordination. A demonstration test is performed by the experimenter.

6. <u>Underhand throw</u>. The participant is given six attempts with a No. 6 ball to hit a target twenty feet distant. The target is a quart milk carton placed on the floor. The score is the number of times the ball strikes the target in four trials. This test measures fine muscle control and eye-hand coordination. A demonstration test is performed by the experimenter.

Appendix B

Talley Sheet

Name____________________
Age_____________________
Grade___________________
School__________________
Group number____________
Assignment number_______

Group Arrangement
1. HP
2. HV
3. P=V
4. HA

PM Tests
1. Balance beam
2. Balance on right foot
3. Reaction time
4. McCloy block test
5. Side-slide
6. Underhand throw

Random administration of PM tests___________________________

1. PM #1_____(number of seconds before losing balance)
2. PM #2_____(number of seconds before balance lost)
3. PM #3_____total time (score is spot on 36 inch ruler
   _____choice score time (total time equals single time plus choice score time.
4. PM #4_____(time in seconds required to complete sequence)
5. PM #5_____(number of times subject can cross center line in twelve seconds)
6. PM #6_____(number of strikes ball makes with target in 24 throws.
7. Bender designs_____total score is equal to sum of subscores.
   _____adequate (score one)
   _____about adequate (score one)
   _____distortions (1 for mild; 2 for moderate; 3 for severe)
   _____rotations (partial is 1; one figure 90 degrees or more is 2; more than two figures rotated 90 degrees is 3
   _____perseveration (one figure is 1; more than one figure is 2
   _____integration lacking (one figure is 1; more than one figure is 2
   _____sequence (rigid is 1; irregular is 1; confused is 1)
   _____figure size (oversize is 1; undersize is 1)
   _____expansive (score 1)
   _____more than one page (score 1)
   _____constricted (score 1)
   _____collision of figure with another (score 1)

_____edge collision (score 1)
_____dashes for dots (score 1)
_____lines for dots (score 1)
_____tremulous line (score 1)
_____dots for circles (score 1)

8. _____Total Myklebust score
9. _____Myklebust auditory score
10. _____Myklebust spoken language
11. _____Myklebust motor coordination
12. _____Myklebust orientation
13. _____Myklebust personal social behavior
14. _____socio-economic level (1, welfare recipient; 2, unemployed; 3, disabled; 4, trades blue collar; 5, high income blue collar; 6, low level white collar 7, high income white collar; 8, owner-operator of small business or farm; 10, professional-technical
15. _____environmental disadvantage (1 is none; 2 is some; 3 is substantial
16. _____number in family
17. _____school grade level
18. _____age (in months)
19. _____achievement scores (1 is above average; 2 is average; 3 is low; 4 is very low)
20. _____WISC/WISC R full scale score
21. _____WISC verbal
22. _____WISC performance
23. _____WISC information
24. _____WISC similarities
25. _____WISC arithmetic
26. _____WISC verbal comprehension
27. _____WISC digit span
28. _____WISC picture completion
29. _____WISC picture arrangement
30. _____WISC block design
31. _____WISC coding
32. _____sex

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